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OBITUARY NOTICE OF JOHN F. FRAZER.

BY JOHN L. LECONTE, M. D.

(Read before the American Philosophical Society, April 4th, 1873.)

In accordance with the wish of the Society, expressed at the meeting of October 18th, 1872, I have prepared the following brief memoir of John F. Frazer, LL.D., Professor of Natural Philosophy and Chemistry in the University, and who held successively the offices of Secretary and Vice-President in this Society :—a man of eminent scientific and general culture ; of singular truthfulness of speech, and integrity of conduct ; a devoted lover of consistency in action, and strict performance of duty ; virtues which he exemplified in himself and sought for in others.

He was therefore respected by his acquaintances, and beloved by his friends, with whom he interchanged a strong and unselfish affection ; one who will live in the memory of those admitted to his intimacy, as of those who have had the good fortune to sit under his instruction.

John Fries Frazer was born in Philadelphia, July 8th, 1812, in Chestnut street, nearly opposite Independence Hall. His father was Robert Frazer, a brilliant and successful lawyer of that time, who married Elizabeth, daughter of John Fries.

He was grandson of Lieut. Col. Persifor Frazer, an active officer in the Revolutionary war.

During his childhood, being placed at school in Philadelphia, he was always among the leaders of his classmates, both in the serious pursuits of the hours of instruction, and in the athletic sports of the recesses. After a year spent, about 1822, at the quasi-military school of Capt. Partridge, in Connecticut, he completed his boyish education under Dr. Wylie, and entered as a student in the University of Pennsylvania.

His acute powers of observation, and the indications of true and manly qualities soon attracted the notice of Prof. A. D. Bache, under whose instruction he now came, and whose influence tended to the development of those scientific tastes, which eventually became the foundation of his continuous work in life. The relations thus established between professor and pupil, resulted, as is rare in the United States, in a tender and permanent affection, which will be referred to at greater length hereafter.

While acquiring his scholastic education, he had the benefit of the most thorough old-time training, which could be obtained in the family of the Rev. S. B. Wylie, D.D., "and in company with his sons, he had been drilled in the classics and mathematics, in a style unknown to these degenerate and superficial days.*"

During his boyhood and adolescence, he was chiefly under the care of his maternal grandfather, John Fries, and afterwards under the general care of Charles Roberts, the father of our fellow-member S. W. Roberts, and of his brother-in-law, the late John Rhea Barton, M. D.

*Penn Monthly, Nov., 1872, p. 630.

While passing through the academic course of the University of Pennsylvania, and for some time after graduation, he acted as the laboratory assistant of Prof. A. D. Bache ; and in this function he aided in determining "with accuracy, for the first time in this country, the periods of the daily variations of the magnetic needle,"* and the connection of the aurora borealis with magnetic forces.

An additional training in physical and natural science was obtained while he held the position of assistant in the Geological Survey of Pennsylvania, under Prof. H. D. Rogers, in 1836.

About this time he perfected his youthful education by a course of law, in the office of John M. Scott, at the end of which he was admitted to practice.

The practice of his profession soon became less attractive than the more laborious, though less remunerative intellectual pursuits, which he had cultivated under the instruction of Prof. Bache. For some time he was Professor in the High School of Philadelphia, when the Professorship of Chemistry and Physics in the University becoming vacant by the resignation of Prof. Bache, Mr. Frazer was chosen to fill the chair. He was then the youngest member of the faculty, and continued to hold the position until his death, when he was the senior Professor, and had been for many years Vice-Provost.

He now devoted himself most industriously to filling the duties of his professorship, and its collateral occupations, among which were many courses of lectures on various branches of physical and chemical science at the Franklin Institute, and the editorship of its Journal, from the year 1850 to 1866 ; the pages of which, during those 17 years, bear evidence of his extensive reading and judicious selection from contemporaneous scientific journals of both continents.

He was elected a member of the American Philosophical Society in 1842, and was soon honored with an official position, being made Secretary in 1845, and Vice-President in 1855. He remained in office until the end of 1858, when owing to some unhappy differences which then distracted the Society, he resigned. He was re-elected in 1867, and was afterwards frequent in his attendance at the meetings, taking part in the discussions which occurred on matters of science and business.

He was one of the fifty original members of the National Academy of Sciences, chartered in 1863 by the Government of the United States : an institution intended to represent the highest scientific culture of the country. The members are pledged to make reports, without compensation, on all subjects of science, on which the opinion of the Academy is required by the Government. After remaining an active member for several years, and serving upon committees, he retired to the grade of honorary member, to make room, as he said, for some more energetic investigator, better entitled to the place.

*Eulogy of Prof. A. D. Bache, by Prof. Joseph Henry. Report of Smithsonian Institution, 1870. p. 7.

The labor of teaching such comprehensive branches of science as Physics and Chemistry, became greatly increased by the rapid developments of modern research, and at length the symptoms of over-fatigue manifested themselves. An obscure affection of the liver had afflicted him for several years, causing frequent and constantly increasing fits of fainting, accompanied with great bodily prostration. In 1856 he was ordered by his physician to seek, in a four months' trip to Europe, a relief which his family and best friends hardly dared to hope would be afforded him. The effect of this brief relaxation was marvellous : not only was he enabled to resume his duties the following autumn with renewed vigor, but the fainting fits did not recur, except in one or two isolated instances, and the development of the hepatic disease seemed to be permanently arrested. Other and equally serious affections resulted from the excessive work to which he again applied himself during the next eleven years, so that another trip to Europe was advised in 1867. This time, sixteen months rest from the labor of teaching, and freedom from anxiety so far restored his health, that on his return, in the autumn of 1868, he was again able to resume the full duties of his chair.

These he continued, without intermission, other than that afforded by the usual vacations, until October 12, 1872, the day following the inauguration of the new University Building, in West Philadelphia. He had taken great interest in this improvement of the institution to which he had given the best labor of his life, and had patiently looked forward to it for opportunities of larger usefulness.

Never, as I have been told by those that saw him on that and the preceding day, had he appeared in better spirits, never more cheerful, although the unusual labor connected with the organization of his departments, and the transfer of the apparatus, with his large scientific library to the shelves in the new building, had entirely exhausted him.

Without premonition of cardiac trouble, which, indeed, though suspected, had never given him any serious inconvenience, and was disregarded in consequence of the graver hepatic disease above mentioned, Prof. Frazer, although much fatigued by the ceremonies of the inauguration of the previous day, went to his laboratory, and having ascended a flight of stairs leading to the apparatus room, dropped suddenly from exhaustion of the heart. Death was instantaneous and although assistance was quickly rendered, all attempts to restore life failed.*

Having thus mentioned the more prominent events in the public life of our deceased associate, it becomes my more difficult and delicate duty to give an analysis of his character, and to exhibit, in however an imperfect manner, the development of the life of usefulness so abruptly terminated.

*By a melancholy coincidence, this sad event took place on the very day on which the writer of this memoir returned after a three years' absence, in the expectation of renewing the warm and long friendship which had thus been interrupted. It was a painful greeting on arriving at home, instead of receiving the hearty grasp of affection, to see the dismal badge of woe on the residence of this valued friend.

The graceful tributes to the memory of Prof. Frazer by those who were closely associated with him in his professorial labors,* leave but little to be added by the pen of one far behind them in scholarly practice, and elegance of diction, though yielding to none in his affection for our lamented friend.

Possessed of great animal spirits, with the usual concomitant of restless activity, and inheriting from his grandfather an ample competence, even the great moral power latent in his brain, at the completion of his professional education, might have served for less useful purposes, had it not been for his fortunate attachment to Miss Charlotte Cave, daughter of Thomas Cave, to whom he was married in 1838, at the beginning of his scientific career as a professor. A union which continued during his life, with singular devotion and affection on both sides, and with an influence for good over each, which may be seen but rarely even in the most happily concurrent dispositions. Two daughters and a son are the issue of this marriage, of whom the last has recently been appointed to the chair of Chemistry, resulting from a division of the functions left vacant by the death of his father.

Next in importance to the domestic influence by which he was thus controlled, must be mentioned a very potent encouragement resulting from friendship.

Prof. Frazer combined to a rare extent, correct æsthetic perception with high intelligence, ease in acquiring knowledge, retentive memory, great industry during the hours of labor, and a strict sense of moral responsibility. These elements of a powerful, useful and conscientious mind, early attracted the notice of Prof. A. D. Bache, the master spirit of American science in those and later days. Under the genial influences of this interest, the somewhat untamed vital energies of youth were directed to the steady and laborious scientific pursuits of adult age.

It was the happy faculty of our great leader, Prof. Bache, to bind to him by most affectionate ties many of those who had been under his instruction, and it is not surprising that the regard for the tutor and professor of his youth ripened in the soul of Prof. Frazer into reverence and affection for the friend of his mature life.

Thus protected by love, friendship, and a strong sense of duty, he commenced the labor of life, and soon acquired by industry and intelligent facility of communication, power as a teacher in physical and chemical science which has been rarely equalled, and never excelled in Philadelphia. "His mind was quick in its action, and penetration beyond example. No man ever mastered a subject more rapidly, or could explain it more clearly or gracefully to others."† "He introduced a thousand anecdotes into his lectures, not only for the purpose of keeping the atten-

*Vide Penn Monthly, Nov., 1872, p. 629, for a touching editorial; *ibid.* Dec., 1872, p. 728, for full reports of the eloquent remarks at the faculty meeting of the University by Professors Allen, Krauth, Lesley and Jackson.

† Allen, Penn Monthly, 1. c. sup. 678.

tion of his scholars awake to the subjects in hand, but to imbue their imaginations with that perfect fairness of judgment and complete collation of the knowledge of men of the past with that of men of the present, by which alone a philosophical character of mind can be formed. This made him a distinguished teacher, and won the confidence as well as excited the admiration of students.”*

As lecturer at the Franklin Institute he was equally fortunate in the lower, though perhaps nearly as useful sphere of popularizing the different departments of physical science, and rendering them comprehensible to persons who had not the preliminary academic training of college students.

During years of laborious teaching he found opportunity to accumulate, and leisure to read (in addition to his special library of 2500 vols.), a large miscellaneous library, which filled one of the most extensive rooms in his house; and I may freely say that I have known few men who could recall, when occasion required, the material derived from such varied and extensive reading. To him could not be applied the ancient and frequently correct text, “Some there are who possess books, and others that understand them,”† and on many occasions, when enjoying, with other students of science, a discussion on some obscure point of ancient lore, scientific, religious, historical or metaphysical, it mattered not which, I have been amazed with the readiness with which he would define the vague impressions of our somewhat treacherous memories, by turning to the exact page of works rarely referred to, and give us the precise information desired.

He could most happily combine the severe labors of academic teaching with industrious study, and with entire relaxation in the hours taken for social or domestic enjoyment, a power rarely found here, though not unfrequent in older communities.

It was by this happy union of qualities that he was enabled not only to keep himself well informed in the progress of nearly every branch of science, but also to retain the results of the classical instruction he received in his youth from Dr. Wylie.

Quickness of thought, great power of conversation, courtliness of bearing towards women, and brilliancy of wit, made him a most attractive member of society; while the genial manner in which his house was open to his friends on one evening of the week, brought around him a circle of laborers in intellectual pursuits. It was seldom that men of science from other States or countries visited Philadelphia without having a welcome in those weekly gatherings, giving and receiving instruction and sympathy in their respective investigations.

While the country suffered from the unhappy struggle which so nearly produced either its disruption or its entire destruction, Prof. Frazer’s adherence to the cause of the Government was most strenuous. Though

* Lesley, *Penn Monthly*, l. c. sup. p. 681.

† Mahabharata, Book I. Section 1. (*Annals of Oriental Literature*, i. p. 69.)

age and ill-health combined to deprive him of the privilege of active military service, he was among the warmest supporters of the military measures rendered necessary by the colossal proportions of the war. He was one of the early members of the Union League—at that time, a most valuable and unpartizan agent, in giving national effect to local patriotism.

On religious subjects the information of Prof. Frazer was almost as extensive as on those which engrossed his daily attention. Under Dr. Wylie he had read a moderately complete course of theology, and was as familiar with the books of the Bible, biblical commentaries, and ecclesiastical history as with any other part of his library.

While thus thoroughly acquainted with the varieties of theological opinion which divide the various sects composing the Christian Church, he was, with the modesty inherent in many men of thoughtful mind and earnest intellectual work, not disposed to obtrude his own personal views, or to take part in any argument in favor of the excellence of one sectarian formula over another.

It is also true that his predilection for the Society of Friends rendered him indifferent to the doctrines and human contrivances by which religious bodies are differentiated, under the gradually increasing influence of higher truth upon social evolution. But this very fact only made him more sensitive to the great principles of conduct and feeling which nominally underlie the various religious structures of modern civilization, and to the necessity of practising in himself and exacting from others an intelligent and consistent recognition of these bases of all vitality of the soul. Judged by the standard of conduct, which is the evidence of inward spiritual light, Prof. Frazer was as eminent for his moral as for his intellectual qualities.

The effects of hepatic disease upon the manifestations of moral qualities are well known to every medical man, and it is not singular that despondent feelings, accompanied with great suffering, occasionally overcame his unusually buoyant nature, and produced at times a quickness of manner and a petulance of language which doubtless gave offence to persons who were but slightly acquainted with him, and caused him to be occasionally harshly judged. But those of us who knew him closely, knew also that these were but the momentary effects of pain in a highly susceptible and active organization, which he endeavored to control, though naturally without constant success.

In his charities he was liberal and unobtrusive; ever ready to relieve distress according to his ability; always willing to work for the interests of even an indifferent acquaintance, when something useful or commendable was to be effected. His maxim was, never to neglect what seemed to be the duty of the moment—not to put off the occasion of usefulness that it might recur at a later period. It was a favorite illustration from physical science with Prof. Frazer, that much of the wrong done in the world was not intentional, but occurred from inattention to *moral*

parallax—that is, by not recognizing the relative importance, subordination, and temporary variations of the manifold duties devolved upon each member of the human family.

“He was a fanatic for truthfulness and fair dealing in science and in everything else, and could not comprehend or make the least allowance for circumstances that threatened to compromise right and wrong. Perfectly fearless himself, and worshipping pluck and courage as the chief human virtues, he gave no quarter to the very shadow of equivocation or unfairness, no matter whom it concerned.”*

It should also be observed, that although Prof. Frazer, judging by the history of former systems of thought, was not inclined to adopt as final truth what may prove to be merely scholastic teaching or glosses upon mediæval tradition, he was equally indisposed to cast aside the foundations of thought, resting upon time-honored belief and long experience, in favor of new systems of philosophy, in which the last half century has been so fertile. He required, before a proposition should be received, before it should be allowed to take the place of what preceded, that the facts upon which it was supposed to rest should be well established. A mere hypothesis, however specious, however ingenious, however pleasing to the vanity of human intellect, by explaining to humblest comprehension things not yet within the scope of our highest investigations (though perhaps quite so in the not very remote future), could never with him take the place of actual science.

To superstition on the one side, to rash and ambitious generalization on the other, as to all pretensions and shams of whatsoever nature—scientific, social, political, financial, or religious—he was a most severe enemy; and it was these things, or rather semblances of things—the spectres which afflict and deform our relations with others—that drew out the bitter denunciations which I have alluded to above as being intensified by the pains of disease, though having a natural origin in the honesty of his nature.

On the other hand, I have never heard from him, even in moments of severe suffering, anything that was intended, and very rarely anything that could be construed as personal. His criticisms, like those of the highest and best examples of conduct, were aimed at classes or groups of persons, looking rather for improvement in motive of action than to punishment for individual offence.

On the Monday after his death, Oct. 14th, 1872, the Faculties of Arts and Sciences of the University met to do honor to his memory. Eloquent addresses were made by several of his colleagues, and a series of resolutions were adopted, expressing the severe loss, both to the institution and the community, in the death of Prof. Frazer. Similar action was taken by the Society of the Alumni, and on the next day the body was followed to the grave by an unusually large and respectable assemblage.

Thus has passed from us one of the most highly educated men with

* Lesley, l. c. sup. p. 81.

whom it has been our privilege to associate—a sad loss to us, and equally so to the community, in which, and for which, he labored with his vast accumulations of knowledge. Without ambition or vain-glory, he was content to give his whole attention to the somewhat monotonous routine of immediate duties in the city, and to be known in the greater world only to those with whom congenial dispositions, similar pursuits, or the accidents of travel had associated him; a combination of modesty, intellect and conscience rarely to be seen. That those who come after us may find in their time an example of equal merit in these qualities, is the fervent wish of all who mourn his lost friendship.

TOPOGRAPHY AS AFFECTED BY THE ROTATION OF THE EARTH.

BY W. C. KERR,

STATE GEOLOGIST OF NORTH CAROLINA.

(Read before the American Philosophical Society, April 4th, 1873.)

The eastern part of North Carolina, which for about 100 miles from the sea has a comparatively level or very slightly undulating surface, whose slope seaward does not exceed an average of one foot to the mile, is occupied geologically by the (sensibly) horizontal strata of the Post Tertiary or Tertiary formations, which consist of uncompacted sands, clays, marls and gravels in various commixture, and is divided by the southeasterly course of four or five large rivers into as many parallel zones or broad flattish swells, which shed their drainage waters northeast and southeast, by a system of small tributaries, into the larger streams. As may be seen by reference to the map the watershed or crest of these zones lies much nearer to their northeastern margin, dividing them into two very unequal slopes or drainage areas.

In the beginning of my explorations in this region the question was often asked by the more observing and intelligent citizens, why the bluffs and high banks are always found on the south side of the rivers, and swamps and low flats on the north. I did not know, and indeed doubted the fact. But my attention being called to it the observation was soon ascertained to be valid to a very remarkable extent. Another question was also frequently asked which presented a difficulty not obviously connected with the former, viz: why the marl beds (Miocene shell beds) are found only *on the south side* of these large rivers. This